A Routine Tool for Detection and Assessment of Epidemics of Influenza-like Syndromes in France

ABSTRACT

A regression model for the non-epidemic level of influenza-like syndrome has been estimated from the 55,200 cases collected between October 1984 and August 1988 using the French Communicable Diseases Computer Network. The start of a major epidemic in 1988–89 was detected early. The size of the epidemic, for the entire country, was estimated at approximately 4.3 million cases. The excess cost of sick-leave, among those of working age, was estimated at $86 million. (*Am J Public Health* 1991; 81:97–99)

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Introduction

Estimation of pneumonia and influenza mortality excess based on forecasting methods has been performed on a routine basis for 25 years in the United States.[1] However, morbidity excess linked to influenza epidemics in the community has never been assessed; the French Communicable Diseases Computer Network (FCDN) provides a unique opportunity to study the feasibility of such forecasts and to measure the impact of such an epidemic in terms of the number of cases and the cost of sick leave.

Methods

Influenza-like Syndrome and the FCDN

The initial version of the FCDN has been previously described in detail.[2] It was initiated in November 1984 under the joint auspices of the Department of Health (Direction Générale de la Santé) and of the National Institute of Health and Medical Research (Institut National de la Santé et de la Recherche Médicale). It presently involves 550 "Sentinel General Practitioners" (SGPs), approximately 1 percent of the total number of French GPs, throughout the entire country. SGPs are recruited on a voluntary basis. Each SGP updates a data base of six communicable diseases, weekly. The SGP communicates with the host computer through a Minitel (a computer terminal and modem provided free of charge by the National Company of Telecommunication to any telephone user in France), at least once a week, even if they have not encountered any case of the disease. This procedure allows for the differentiation of a physician who observed zero cases from a non-responding physician for any given week. Each week 50 to 60 percent of the physicians respond. Criteria for inclusion of influenza-like syndrome cases are those of the World Health Organization[3]: a sudden fever of over 39°C with myalgia and respiratory symptoms.

The Regression Model

The concept of excess mortality has been applied to influenza by Serfling.[4] It is based on a regression model which fits the non-epidemic data and predicts a non-epidemic level curve. We deleted the cases for the past epidemic periods (defined as periods above three cases per SGP). We then fit the following regression equation to data from 1984 to 1988 to forecast the expected non-epidemic level for the following winter (1988–89):

$$y_t = 1.322 - 0.003*t + 0.002\cos(2\Pi t/52) + 0.841 \sin(2\Pi t/52) - 0.055\cos(4\Pi t/52) - 0.129\sin(4\Pi t/52) + \epsilon_t$$

where y_t is the number of cases per SGP in week t, and ϵ_t is the independent, identically distributed random error (with mean 0) associated with the cases in

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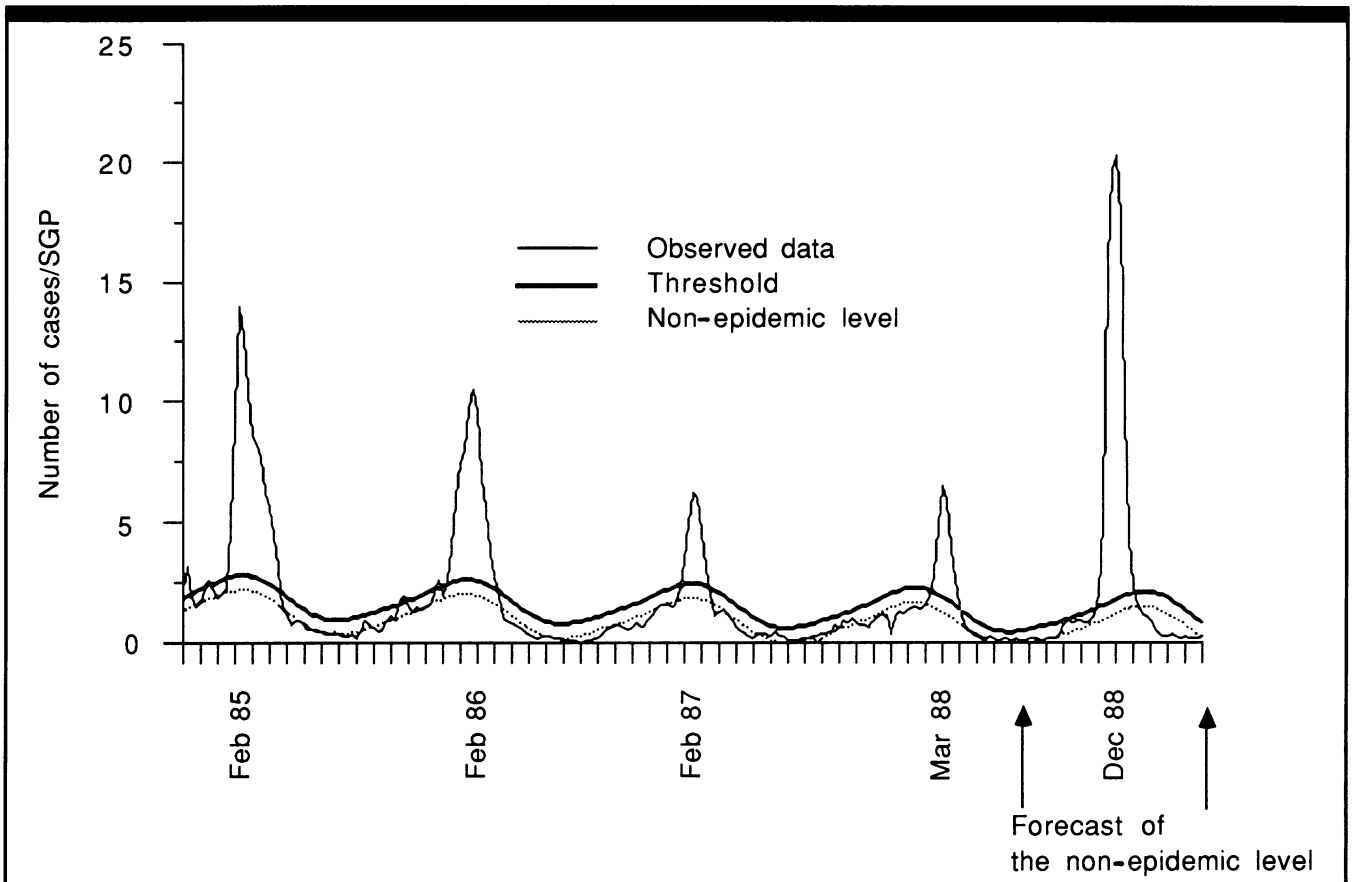

FIGURE 1—A model to estimate the non-epidemic level of influenza-like syndromes was fit to the non-epidemic data of 1984 through 1988. The model was then used to forecast the non-epidemic level for 1988–89. The threshold is defined as the upper 95% confidence interval of the non-epidemic level (one tick mark every 4 weeks).

week t. The parameters were estimated by the least squares method.

Application to the French Data

We applied this method to our morbidity data set. Parameters of the model were estimated from data collected between November 1984 and August 1988. Then, retrospectively, we predicted the non-epidemic level and the threshold from September 1988 until July 1989. The threshold is the upper 95 percent confidence limit of the non-epidemic level forecasted by the model. An epidemic is defined when the threshold was exceeded for two consecutive weeks.

Results

As the differences between observed and calculated data during the non-epidemic period exceed one case per SGP during only four weeks of the nearly 200 weeks used to establish the model, it was considered that the model accurately reflected the situation observed during the non-epidemic periods. During the previous winter, we observed an epidemic (i.e. above the threshold) that began November 14, 1988 and ended January 15, 1989. With the model, we could have concluded that an epidemic was present on November 21, 1988 (Figure 1). The size of the epidemic was measured as the cumulative number of cases per SGP above the expected number. This was estimated for France assuming that the FCDN is representative. During the winter of 1988–89, the epidemic size was estimated at 4,291,805 cases. The excess cost of sick leave among the working age group (around 50 percent of the cases[5]) was estimated at approximately $86 million. The cost of sick leave for one case of influenza-like syndrome at $40 is based on the estimate (provided by the SGPs) of the mean number of days of sick leave, i.e. 5.8 for an influenza-like syndrome, and on the daily Social Security rate for sick leave, i.e. $14.30. This estimate takes into account the fact that the first three days of sick leave are at the patient's expense.

Discussion

This simple tool has demonstrated its efficacy within our data set. The method was used to forecast the 1989–90 non-epidemic level of influenza-like syndrome and to notify the medical community when the epidemic began (during the last week of November 1989). It was also useful in assessing the public health impact of influenza-like syndrome in France.

Until now, only mortality data have been used to forecast non-epidemic patterns. Several problems are worth noting with mortality data.[6] In addition to delay in reporting, there is a lag between the increase in the number of cases of influenza-like syndrome and the increase in the number of deaths attributed to pneumonia and influenza. Furthermore, some epidemics can escape detection, if associated with insignificant mortality excess, e.g. when few people 65 years of age and older are attacked by the epidemic. Mortality data only allow the quantification the mortality excess.

Hospital morbidity data have also been used to assess the cost, but reflect only the most severe cases.[7] Morbidity data collected on line from SGPs have allowed both a rapid detection of an epi-

demic and the quantification of the impact of such an epidemic in terms of sick leave.

The development of tools, currently in progress, will permit the use of the same method on a regional basis. The tool described here, in association with other methods developed at our center[8] will allow the prospective prediction of future epidemics and assessments of their economic impact with reasonable accuracy. □

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Antibiotic Use among Children in an Urban Brazilian Slum: A Risk Factor for Diarrhea?

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ABSTRACT

Among a cohort of children in a poor urban setting in Brazil, the relative risk for the occurrence of a new episode of diarrhea in the two weeks following antibiotic use vs all other weeks was 1.44 (95% confidence interval (CI) = 1.33, 2.45). Among children never exposed to antibiotics, the odds ratio was 1.34 (95% CI = 0.84, 2.16) after stratifying by individual child and controlling for previous diarrhea. Further research is needed to confirm whether antibiotics are a risk factor for diarrhea in such settings. (*Am J Public Health* 1991; 81:99–100)

Introduction

Antibiotics are commonly used and can be obtained without prescription in many developing countries.[1] Although antibiotics are valuable treatments of many infectious diseases, they are not without risk. Potential problems associated with their use include the selection of resistant bacteria[2] and the development of serious side effects, including antibiotic-associated diarrhea.[3] Furthermore, the use of antibiotics has been documented to predispose to symptomatic *Salmonella* gastroenteritis.[4] We therefore hypothesized that antibiotic use might be a risk factor for diarrhea among a cohort of children in a community setting where the likelihood of exposure to infection was high.

Methods

This study was part of an illness surveillance project[5] undertaken from 1984 to 1986 in a three block area of a slum in the northeastern Brazilian city of Fortaleza, which has a population of nearly two million. Thrice weekly visits were made by trained community health workers to the homes of a cohort of children less than five years of age. At each visit, a history of any diarrhea since the previous visit was obtained from the caretaker of each child. Diarrhea was defined as an increase in stool frequency or decrease in consistency as noted by the caretaker. At least three diarrhea-free days separated episodes.

Antibiotic use was determined over a 16-week period (January-April 1986) by weekly visits by one of the authors (JBS) to each of the 45 homes of the 105 children enrolled in the cohort at the time. A standardized questionnaire was employed to obtain information concerning antibiotics used by the children during the previous week. An antibiotic course was defined as one or more doses of a drug, given at least daily with less than two days interruption.

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